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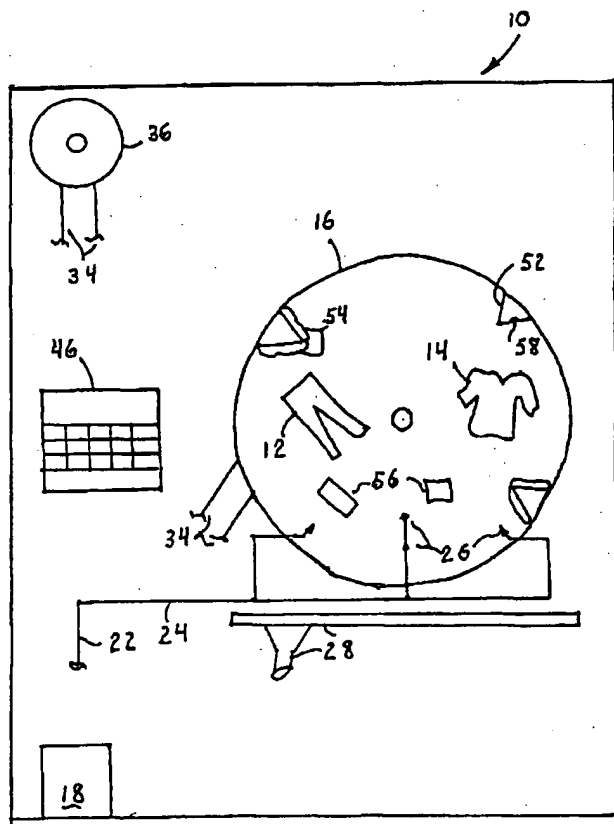
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(54) Title: TEXTILE CLEANING PROCESSES AND APPARATUSES



(57) Abstract: Processes and apparatuses for commercial and home-use cleaning of textile. Home-use embodiments replace the home laundry clothes dryer, except for embodiments using a novel manual kit. Home-use embodiments have an integrated spotting station. Soiled/stained textile is spray dampened with solvent, preferably automatically in the apparatus' rotatable drum (16), but the textile is not soaked nor immersed insolvent. Highly absorbent, untreated pad material (54,56) is placed into the drum (16), for rubbing against the tumbling textile, to remove the soil, stains and solvent.

WO 02/08510 A1



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## Textile Cleaning Processes and Apparatuses

### CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S.  
Provisional Application Serial No. 60/220,663, filed on  
July 25, 2000, entitled DRY CLEANING PROCESSES AND  
5 APPARATUS.

### BACKGROUND OF THE INVENTION

#### Field of the Invention

This invention concerns textile cleaning processes  
and apparatuses, useful in commercial facilities, group  
10 housing and private dwellings.

#### Prior Art

Dry cleaning processes and apparatus have been in  
use commercially for a considerable length of years. For  
the most part, commercial processes have changed/improved  
15 relatively little except for the use of less dangerous  
solvents. Likewise, commercial dry cleaning equipment,  
except for more automation, is mostly the same for the  
past fifty years and do that which was done previously.

Commercial dry cleaning, as is well known, is not a  
20 dry process, it is basically a waterless process, using  
liquid solvents, in which the soiled textiles are

immersed and mixed in a rotating drum until the soil transfers from the textile into the solvent bath. An historic problem in the commercial dry cleaning equipment and process was the use of solvents which were dangerous to handle and inhale, had low flash points; and when disposed, both as liquid and vented to the atmosphere, were environmentally hazardous/unfriendly. In at least countries where health and environmental regulations are enforced, those historic problems of the solvents have been eliminated or greatly diminished by user and environment friendly solvents. However, the volume of solvent needed to immerse the textiles in the drum presents its own problems: cost, storage space, proper disposal, filtering and recycling, etc.

Quite recently, there has entered the market place kits for home-use, in home clothes dryers, for freshening and cleaning of garments which cannot be washed in water and are not so soiled that commercial dry cleaning should be used. Although such kits are convenient to use, their capability to satisfactorily remove soil is limited. Such kits have solvent impregnated, small, thin sheets which are put into the dryer drum with the soiled garments. The heat within the rotating drum releases the solvent from those sheets into the atmosphere of the drum. The tumbling garments are "immersed" in the

solvent containing atmosphere for the cleaning function.

The sheets also are impregnated with a pleasant fragrance substance, to impart a clean smell to the garment. Some kits also include pre-spotting solution, to be applied to selected soil spots of the garment, prior to being placed into the dryer drum. A problem with the use of such kits is that either extensive pre-spotting is needed, or the cleaning is inadequate, or both. Some kits also include a bag into which the garments and impregnated sheets are placed. The bag inhibits the garments from contact with the hot interior surface of the drum and also confines the solvent containing atmosphere.

15

#### SUMMARY OF THE INVENTION

The novel features of this invention overcome prior art dry cleaning problems, provide a more efficient commercial and home-use textile cleaning apparatuses and processes and also provide a more effective home-use textile cleaning process suitable for a kit. An important "component" of the invention, for both the commercial/professional embodiment and the home-use embodiments, is the employment of highly absorbent, untreated pads, which are placed in the dryer drum, for the purpose of rubbing against the textiles, so as to

remove soil and absorb cleaning solvent which is sprayed on the textiles.

In the commercial and automated home-use embodiments, the textiles are not immersed in solvent. A  
5 sufficient, small amount of solvent is sprayed, onto the textiles when inside the drum, early in the cleaning process. Thereupon, rotation of the drum brings the textiles and pads into frictional contact, repeatedly. The pads can be removably fastened to the "lifting" ribs  
10 and body of the drum and/or be free to move about in the rotating drum. For this home-use embodiment, if there are no ribs to secure the highly absorbent, untreated pads, the pads are placed loosely in the drum.

In a manual home-use embodiment, the textiles are  
15 sprayed, not soaked nor immersed, with the cleaning solvent, prior to being placed into the drum.

A highly effective, home-use process and unit includes a soil spotting station, which is integrated with the solvent spraying and absorbing pads in the drum.  
20 If purchase costs and consumer demand required, three hybrids of the home-use unit and process could be provided: (1) Having both in the drum spraying of the textile and a spotting station; (2) omitting in the drum spraying, and replacing it with the manual kit K, but  
25 retaining the automated spotting station; (3) retaining

the in-drum spraying and the in-drum pads, but omitting the spotting station.

As employed herein, the term "textile" is used generically to encompass garments, fabrics, cloth, and all other materials which typically are dry cleaned, rather than washed in water. The term "solvent" also will be used generically to encompass dry cleaning solutions as known historically, recently formulated, water based, and formulated in the future for the intended purpose. "Drum" encompasses the old types of dry clean wheels as well as present and future drum-type commercial (professional) apparatus which rotates around at least one axis, holds the soiled textiles and historically also the immersing solvent. "Drum" also includes the rotating part of commercial dry cleaning machines and domestic clothes dryers. "Pad" is a generic term, unless specifically limited, and encompasses a wide variety of materials, shapes and sizes, but is not to be confused with the thin, small solvent/freshener impregnated sheets used in the prior art home-use kit K.

"Untreated" is a limiting term to the pad and means that the pad does not contain/not impregnated with cleaning solvent, as it taught in the prior art.

Other features of the improved process and apparatus will be disclosed in the next following detailed description.

5

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is side view of the commercial cleaning machine of the invention, with its side cover removed and somewhat pictorial, showing major component parts;



FIG. 2 is a front view of the cleaning machine of Figure 1, with its front cover off, somewhat pictorial, showing major component parts, with pads and textile in the drum;

5        FIG. 3 is a partial side view of a home-use unit, with its side cover removed;

FIG. 4 is a partial top view of a home-use unit, somewhat pictorial and broken away to show the spotting station; and

10       FIG. 5 is a pictorial illustration of the contents of a home-use starter kit, with components not to scale with respect to each other.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

15       Described first will be the home-use, suitable for a kit sold in grocery stores, embodiment. As shown in FIG. 5, the contents/components of a starter kit K would be: a bottle 1 of solvent 1', preferably with a spray dispensing head 2; a plurality of highly absorbent, untreated pads 3, and instructions 4 for their use in a standard, home style, clothes dryer. Optionally, the kit K also could include a one-use or repeat-use containment bag 5 for holding the textiles and pads in the drum of the dryer, one purpose of which is to keep the textiles  
25       hydrated with the solvent for a sufficient time. Another

optional component, especially useful if a containment bag is not used, is covering means 6, positionable over the typical lint filter of the home style dryer, to reduce air flow from the dryer drum, thereby to keep the  
5 textiles hydrated with the solvent for a sufficient length of time; so that their frictional contact with the pads is such that the pads are rubbing over the damp textile, to rub off the soil and absorb the solvent. Also optional, but preferred, is a container 7 of spot  
10 removing liquid 7' having an applicator tip and a spotter bone 8 and brush 9; to be used before and/or after cleaning by the process of this invention, as might be needed for stubborn/unique spots of soil.

The pads 3 for this home-use unit embodiment can be  
15 of a wide range of shapes, sizes and materials; and, for that reason, are not shown in detail in any Figure of this specification. These pads should have enough mass to frictionally confront and rub against the textile. A thickness of about one-quarter to one-half inch (about  
20 0.60 to 1.25 cm.) has worked well with surface areas of ten to fifty square inches (about 65 to 325 cm. sq.). The quantity of pads depend upon their sizes, the amount of textile material to be cleaned, the volume of the drum, the duration of drum rotation, the rate of solvent  
25 evaporation and extent to which the textile is soiled.

Additional variables are the material of the textile and its thickness. Also, some solvents can function better at different temperatures than others, which can affect their evaporation rate. The quantity and weight of the  
5 textiles being cleaned and the amount of the pads should be such that the random tumbling movement of the pads and the textiles in the rotating drum causes a considerable amount of surface-to-surface rubbing contact therebetween, which is essential for adequate cleaning by  
10 this process. The material of the pads is to be highly absorbent, smooth texture and not the source of and undesirable amount of lint from its own body or because of its rubbing against the textile. Cotton, felt, terry, etc. are materials of the type which provide the  
15 absorbence, smoothness and weight desirable for a pad to be used in both this home-use and the commercial embodiments of this invention. Preferably, the pads can be used for a few loads of cleaning, before they are too dirty to be used again. Then, they can be cleaned/washed  
20 for further use.

The solvent 1' and the optional pre-spotting liquid 7' can be selected from any of many existing, as well as future formulated, user friendly and environmentally approved liquids, including water-based cleaners and

water diluted mixtures thereof. A few examples of such solvents are:

DF-2000, a synthetic aliphatic hydrocarbon manufactured by Exxon Chemical Co., Houston, TX.; Vista LPA-142, a  
5 paraffinic, maphthenic, manufactured by Vista Chemical Co., Houston, TX.; N-Ta Germ Liquid, an alkyl dimethyl benzyl amonium chloride; N Ta Germ Wet Clean additive: DWX-44 detergent, DWX-Spray Spotter, Kleerospray Spotter, Nature-L additive, each manufactured by  
10 Kleerwite Chemical, Burke, VA; Cal-Off, a pre-spotter, diethylene glycol methyl ether, manufactured by Caled Chemical, Wayne, NJ; and Zuds, a water based spotting compound, also manufactured by Caled Chemical.

Experience to date indicates that the solvent can  
15 contain at least 75% water and the spotter should be more concentrated. As is known, a spotting solution can be used before and/or after the textile is cleaned in the drum.

The optional containment bag would have sufficient  
20 volume to hold a few garments/textiles and the above identified pads 3, such that the textiles and pads can tumble freely within the closed bag as the drum rotates.

The bag would have some form of closure 5' and be of a material which can withstand repeated use. It can have  
25 one or more layers, one of which would be somewhat vapor

impermeable, to reduce the rate of evaporation of the cleaning solvent; whereby, the solvent can be of maximum use in working on/in the textile, for removal of the soil and the used solvent onto the pads. In a preferred embodiment of the containment bag 5, it would have an inner layer or liner 3' of the pad material, to enhance the rubbing off of the soil from the textiles. Having some or all of an inner layer 3' of the highly absorbent, untreated pad material can reduce the amount of the pad pieces 3 otherwise placed into the containment bag, or the drum, if there is no bag. Under some conditions of textile material and soil content, it would be sufficient for the pad inner layer to obviate need for the individual pieces of pad. Hence, the term "pad" for the home-use unit, encompasses the three conditions of: (a) only loose pieces of pad 3; (b) only an inner layer or liner of pad 3'; and (c) both (a) and (b).

As noted above, it is important to keep the textiles hydrated with the solvent 1' for a sufficient duration, without immersing or soaking or even wetting down the textiles prior to placing them directly into the drum, or into the containment bag which then goes into the drum. Preferably, the textiles are only mist-sprayed with the solvent. Accordingly, especially when a containment bag is not employed, the home-style dryer should be inhibited

from the extent/rapidity of its normal venting, by reducing the amount of air flow into and out from the drum. Typically, the primary amount of venting air passes through the lint filter. Hence, blocking of the  
5 lint filter will reduce the solvent evaporation rate. Such blocking can be partial or total and can be accomplished in various ways by various means; one simple means would be the insertion of a piece of fabric 6 into and covering the lint filter.

10 There is to be no concern over attaining too much heat in the rotating drum or at the lint filter, since the dryer is to be operated without use of heat, such as in the "air fluff" mode. The temperature range within the drum would be home interior ambient, 60° to 95° F,  
15 (about 15° to 35°c). Possibly, a small amount of heat could be used if the dryer was in a cold location, or if a specific solvent worked optimally at warm, not hot, temperature.

The duration of textile tumbling in the dryer drum  
20 with the highly absorbent, untreated pads, will depend upon the size of the drum, the size of the load, the amount of pads and the textile material. About 20-30 minutes usually will be needed. It is to be appreciated that the cleaning process according to this invention

does not require that the textile be dry before removal from the dryer. To the contrary, if the textile is too dry, it could wrinkle. Preferably, the textile is removed from the dryer drum and containment bag if such  
5 bag is used while the textile is slightly damp. Then, the textile is placed on a hanger or the like to dry without wrinkling.

If the textile should be pre-spotted with the spotter 7' prior to mist spray with the solvent 1', or  
10 post-spotted after removal from the dryer, depends upon individual circumstance. As is well known, some specific spots are more easily removed by certain spotting solutions. Hence, the kit K form of this invention can contain more than one spotting solution; or different  
15 spotting solutions can be packaged separately from the starter kit K. Also, there can be "refill" kits containing the primary solvent, with or without additional pads, with or without additional containment bags.

20 Although most of the soil removed from the textile will be deposited onto the pads by virtue of rubbing thereagainst, some of the soil will be released directly from the solvent treated textile into the atmosphere of the drum; and some of the soil might come away from the  
25 pads and also be released into the drum atmosphere. To

avoid redeposition of the atmosphere entrained soil particulates onto the textile, there needs to be a sufficient air flow out from the rotating drum, primarily via the lint trap/vent. Such need for venting air flow

5 is in opposition to the need to retard solvent evaporation by at least partially blocking the lint trap as with the cover 6, as above discussed. A balance between these two needs should be accomplished to optimize the cleaning process and can be termed

10 "regulated air flow". If a containment bag is employed, the "regulated air flow" function can be accomplished by the amount of vapor impermeability of the bag by itself, or in combination with partially blocking the lint trap.

In as much as cleaning by the home style dryer

15 process and kit K/components of this invention is more complete than in the prior art, freshness scent does not have to be used; however, some users might prefer an added freshness, which could be provided via an optional scent impregnated and releasing sheet to be put into the

20 dryer. If the need for freshness scent was dominant, the scent could be incorporated into the solvent or the pads or the containment bag. However, the presence of such freshness scent in/on the pads does not alter the fact that they are highly absorbent and untreated with respect

25 to the cleaning solvent.



From the above description of the kit K for the home-use, the process with its required and optional steps should be understood to be as follows:

1. (Optional) Examine textile to decide if pre-spotting  
5 is needed.
2. (Optional) Pre-spot with the spotter 7', bone 8 and  
brush 9.
3. Mist spray entire textile with cleaning solvent 1'.
- 4a. Place soiled textile and untreated rubbing pads 3  
10 into the drum of the dryer; or
- 4b. Place the textile and the pads into a containment  
bag 5 and put the bag into the drum; or
- 4c. Place the textile into a containment bag 5 having  
therein pads 3' and put the bag into the drum.
- 15 5. Regulate air flow through the drum; which can be by  
use of the containment bag 5 and/or the lint trap  
cover 6.
6. Employ a drum temperature of home interior ambient.
7. Rotate the drum for a time sufficient for the  
20 textiles and pads to rub against each other to  
transfer soil from the textile to the pads and for  
some of the solvent to be absorbed by the pads.
8. Remove textile from drum prior to the formation of  
wrinkles, usually when slightly damp.
- 25 9. Hang the garments for wrinkle free drying.

10. (Optional) Post-spot the textile.
11. Remove pads from dryer and/or containment bag.
12. (Optional) Examine the pads and/or containment bag  
to verify that they are sufficiently clean for  
5 subsequent use; and cleanse them if not sufficiently  
clean.

The process of the commercial/professional  
embodiment of this invention is very similar to the home-  
10 use embodiment, except it takes advantage of being able  
to use some existing commercial dry cleaning technology  
and improve upon it. Primarily, the novel features of  
the commercial embodiment are: (1) The solvent mist  
spraying and air/water/steam jetting upon the textile are  
15 automatically accomplished in the drum, while the drum is  
rotating and during rotation dwell times. (It is to be  
emphasized that the textile is not immersed in a solvent  
or water bath, nor soaked in the solvent or water.) (2)  
The untreated, highly absorbent pads are secured to the  
20 lifting ribs of the drum. (3) Regulation of air flow,  
drum temperature, drum r.p.m., solvent spraying, and  
moisture level are accomplished by sensors and computer  
controls.

More specifically and with reference to FIGS. 1 and  
25 2, the commercial textile cleaning machine 10 can be an

existing piece of equipment, modified to employ the novel process of this invention. However, a new, simpler, textile cleaning machine 10 can be built to perform the new method.

5       With reference to Figs. 1 and 2, which show somewhat pictorally the side and front views of a commercial dry cleaning machine 10, with cover panels removed, embodying the invention, but showing only major components; it will become evident to those skilled in the art that the  
10 machine 10 is simpler than an existing commercial dry cleaning machine, can be less rugged, more economic and simpler to use. Since the process employing the machine. 10 does not immerse the textile 12, 14 in a solvent bath, nor even soak that textile in solvent, there is no need  
15 for placing many gallons of solvent into the drum 16; thus avoiding having hundreds of pounds of solvent supported in the revolving drum. There is not any expensive and bulky solvent recovery and recirculation system, since less than one quart (one liter) of solvent  
20 is needed by the invention per twenty-five pound (11 kilograms) load and mostly is absorbed by the untreated pads and/or are vented out with the soil particulates. Hence, the solvent container 18 can be housed easily within the machine 10 and connected to a pump 20, which  
25 will pump the solvent into the drum 16 as a spray mist,

via lines 22, 24 and jet heads 26. The solvent tank 18 can represent a plurality of tanks coupled in parallel and holding different: solvents, conditioners, sizing, water proofing, fire proofing, etc. substances. The pump 5 20 can generate 60 to 110 p.s.i. Alternately (not shown), a barrel or large tank of the solvent can be located outside of the machine 10 and connected to the pump 20. Since the pump is moving a small quantity of solvent, it can be smaller then presently needed in 10 commercial dry cleaning equipment. If there results a small volume dirty waste liquid, it can be collected from the drum by waste disposal means 28, 30 and then removed according to regulatory/environmental procedures, which could be as simple as flushing down to a sewer; which is 15 especially a viable form of waste disposal, since a preferred embodiment of the solvent can be water-based.

Since the drum 16 is not to contain a heavy volume of solvent, it can be a lighter structure, have lighter support and be rotated by a smaller motor 32, coupled to 20 the rear 33 of the drum via a belt 34, driven shaft 35, etc. than present dry cleaning machines. The motor 32 also can be used to drive the air circulation fan 36, but separate motors (not shown) could be more practical. The interior periphery of the drum 16 is perforated 38, as is 25 typical, so that not only the air circulated by the fan

36 can enter the drum, but especially the jet mist spray of solvent 18, can enter via the jet heads 26, which are positioned next to the drum. The jet heads 26 also can supply air only, or pressurized water from an interior supply 39 or an exterior supply, or a mixture of air and water. The jet heads 26 are position to direct solvent, etc. along the axial direction of the drum and at right angles thereto, so as to dampen the textiles from plural directions. Since the rear end 33 of the drum 16 is closed, except for the perforations 38, the jet heads 26, pointing into the drum's rear end, would be journaled (not shown) for rotation with the drum. For ease of viewing the Figs., the perforations 38 are not shown in Fig. 2 and only a few are shown in Fig. 1.

For the same reason as discussed for the home-use embodiment, the commercial embodiment requires the textile 12, 14, to remain damp with solvent; hence, solvent evaporation rate needs to be retarded/controlled.

Such control is provided by a damper 40, which is located in an air output line 42 and an air recirculation line 44 that returns air from the drum to the input side of the fan 36, for reintroduction into the drum, via the perforations 38. If the damper 40 is closed, the recirculating air, which also carries solvent moisture, is passed through a lint and dirt filter 41 and returned

to the drum to help in continuing the hydration of the textiles. If the damper is open, the moist air can pass outward through the output line 42. If needed, to increase the hydration, moist air and/or steam can be  
5 supplied through the jet heads 26 from a line 45, which is connected to a source (not shown), such as a small external boiler. Such steam/moisture also can be supplied at selected times to: clean water soluble stains; reactivate solvent on the drying textiles; and  
10 give a final "hand" to the textiles. Also, the fan 36 can be turned off as well as have its speed changed, via a program panel 46. The program panel 46 is connected to preset the sequential operations of the machine 10 into various modes, as well as enable random inputs by an  
15 operator. Opening and closing of the damper 40 is one of the many operations via the program panel 46.

The machine 10 also includes an air compressor 48, which can be part of or separate from the pump 20, but can be used in conjunction therewith. The compressor can  
20 be used to provide the jet action for the jet mist solvent spray through the line 22, 24 and jet heads 26. Also, the compressor 48 can supply jets of air, without accompanying solvent, through the jet heads 26, for purposes discussed further below, and for propelling  
25 steam/moisture from line 45.

A heater 50 is provided to warm the circulating air.

The program panel 46 controls when the heater is on and what temperature is to be provided. Programming also controls various valves, only a few of which are  
5 illustrated in Fig. 1. The term "program panel" is used herein to represent all needed programming means, sensors, etc., etc., since such programming means and operations are well within the skill in the art.

Typically, drums of dry cleaning machines contain a  
10 plurality of textile lifting ribs 52 which cause the textiles to be lifted away from the periphery of the rotating drum and tossed toward its axis of rotation. Such ribs 52 play an important additional roll in the present invention. The highly absorbent, untreated pads  
15 52 are removably mounted along these ribs. For ease of viewing Figs. 1 and 2, only a few of the ribs 52 are shown, and only three of the ribs, one in Fig. 1 and a different two in Fig. 2 have pads 54 mounted thereon. In actual practice, both sides of each rib 52 can support  
20 pads 54. If there are four ribs 52 in a drum and they project radially inward five inches and are thirty six inches long (about 13 cm. high and 90 cm. long), they can support approximately one thousand, four hundred and forty square inches of pad, which is ten square foot of  
25 surface (approximately 9,360 cm. sq.). The rotation of

the drum 16, for twenty to thirty minutes, with this pad surface, will result in a significant amount of soil removing, rubbing contact between the textiles 12, 14 and the pads 54. If conditions require more pad surface, the  
5 drums can be built with more ribs; also, loose pads 56, as employed in the home-use embodiment, can be put into the drum 16. Typically, the ribs 52 are perforated, or can be perforated as at 58. The pads 54 can be provided with clips (not shown) for detachably mounting the pads  
10 onto the ribs. Other mounting means, such as velcro or adhesives can be used, so that the pads can be removed for periodic washing and/or replacement.

The access door 60 into the drum 16 is provided with a safety latch 62, which inhibits all machine operations  
15 if the latch is open. However, this safety feature can be overrode by a special command from the control panel 46. The motor 32 normally is preprogrammed to reverse the direction of the drum rotation a few times each minute, with a dwell time of a few seconds, to increase  
20 the tumbling action of the textiles and their soil removing rubbing against the pads 54. The speed of the motor 32 is moderate --20 to 50 r.p.m.-- but could be programmed with other speeds. The jet heads 26 nearest to the access door 60 can be mounted through that door.  
25 Thus, when that door is open, the jet heads and



associated fluid lines, such as the line 24, will not interfere with easy entry and removal of the textiles.

- The process for using the new textile cleaning machine 10, or an old commercial dry cleaning machine modified to have the basic new components needed to carry out the process of this invention would be:
1. (Optional) determine if the textiles 12, 14, need to be pre-spotted.
  - 10 2. (Optional) Pre-spot the textiles before placing them into the drum 16.
  3. Ascertain that the machine 10 has been provided with suitable solvent 18 and pads 54.
  4. Program the machine operations via the panel 46  
15 and/or select one of the existing programs.
  5. Place the textiles 12, 14 into the drum 16 and close the door 60 to enable the safety latch 62.
  6. Start the programmed operation of the machine from the panel 46, such program having steps of:
  - 20 7. Engaging the motor 32, the fan 36 and the compressor 48 for a period of time, such as five minutes, to blow jets of air through jet heads 26 to loosen from the tumbling textiles, dirt and lint, for their removal past the damper 40, which has opened the  
25 output line 42.

8. (Optional) Supply pressurized steam, via the line 45, through the jet heads 26, to remove water soluble stains from the textiles 12, 14.

5

9. Close the output line 42 via damper 40, pump solvent 18 through the misting jet heads 26 for a period of time of one to five minutes, depending in part upon the material of the textiles, the size of the load, the extent and nature of their soil. The amount of solvent is to dampen, but not soak the textiles. Since the textiles are not to be immersed in solvent, as in conventional commercial dry cleaning, nor be soaked with solvent; but only have solvent mist jet sprayed thereon to dampen or wet the textiles, the process of this invention could be identified by the term "Dry -Wetcleaning <sup>TM</sup>".
10. Regulate the temperature in the drum and the hydration/evaporation rate of the textiles by the heater 50 and/or the fan 36 and by opening and closing the recirculation line 44 via the damper 40; as well as by injecting moisture, via the line 45, through the jet heads 26. Such regulation can start with step 9 or later in step 11.

20

11. Continue the tumbling/rotating/cleaning for ten to twenty-five minutes after the injection of the solvent has stopped, but do not continue if the textiles are becoming too dry, which can cause wrinkling to occur.
12. Open the output line 42 and close the recirculation line 44, via the damper 40 for a few minutes to enable particulate soil, solvent aerosol and lint to be blown out the output line 42, and to aerate the textiles.
13. The programmed process has been completed, the safety latch 62 is released by the program and the door 60 can be opened to remove the cleaned textiles, which can be slightly damp, but suitable to go to the presser and/or placed on hangers.
14. (Optional, but desired) Examine the textile for need to post-spot and/or re-do the cleaning of the textile with the same or a different program.

A significant improvement in a home-use textile cleaning process and unit 64 next will be described with reference to FIGS. 3 and 4. This unit and process employ both the mist spraying of solvent air and water into the drum and the highly absorbent pads of the commercial embodiment of FIGS. 1 and 2; hence, it does not use the textile containment bag 5, nor the manual pre-spraying of

the solvent onto the textiles, as described hereinabove with reference to FIG. 5 and the home-use kit K. This home-use unit 64 basically starts from a typical home-use clothes/laundry dryer, with its horizontal axis, rotatable drum, heater, filter, etc.; hence, these components are not shown in FIGS. 3 and 4. Also not shown is the typical front loading access door and electric controls.

It is to be understood that this new unit 64 also continues to be usable as a typical home-use laundry room clothes dryer.

FIG. 3 shows the right side 66, near its rear, with its side panel 68 removed, of the home-use unit 64. A refillable supply of Dry-Wetcleaning™ solvent is supported in a container 70 in the interior of the unit 64 and has its capped refill opening 72 projecting out from the top of the unit. A plurality of spray heads 74 are coupled to both the solvent container 70 and a compressor 76, so as to be able to spray solvent through perforations (not shown) in the typically non-rotating end cover 78 of the rotatable drum (not shown); whereby, textiles in the drum can be dampened by the solvent, similar to the jet spray solvent dampening in the commercial embodiment of FIGS. 1 and 2. The compressor

76 also feeds air pressure to portions of the spotting station, via one or more lines 80.

If the interior of the drum has lifting ribs, such as the ribs 52 shown in FIG. 2, or the interior of the drum is adapted to have pads 54 secured thereto, then the solvent spray dampening and the textile cleaning by rubbing against the absorbing pads 54 will be accomplished in much the same manner as in the commercial embodiment disclosed with reference to FIGS. 1 and 2; exceptions being that in that embodiment there is more automation and the drum 16 can rotate in opposite directions, between which there can be programmed dwell time used for additional spraying of the solvent, etc. If the pads 54 are not secured to the interior of the drum, or such pads do not provide sufficient rubbing and absorbent surface, loose pads 56 would be placed in the drum.

A spotting board 82 is mounted inside the top of the unit 64 and is just below a hinged cover 84, as shown in FIG. 4. The spotting board is coupled by a line 86 to a source of vacuum 88. As is well known in commercial dry cleaning facilities, the spotting board is a hollow chamber having a top surface 90 which is perforated. When the vacuum source 88 pulls a vacuum, evaporating solvent, aerosols and small particulates, such as from a

soiled textile (not shown) lying on the spotting board surface 90, will be drawn from the textile through the perforate surface 90, and out to waste. The vacuum source 88 can be turned on and off via a small switch 92, that responds to the opening and closing of the hinged cover 84. The vacuum source 88 preferably can be the exhaust fan. Removing stains, spots etc. would be accomplished as at commercial dry cleaning facilities, by use of hand held sprayers 94 and 96 respectively containing solvent and water. It would be desirable if at least one of sprayers also could jet a stream of air, without any liquid. The sprayers would be refillable manually and have finger tip control over the amount of fluid being dispensed onto a textile lying on the surface 90 of the spotting board 82. A spotting bone 8 and brush 9 can be mounted conveniently to the right side panel 68, as also could be mounted the sprayers 94 and 96.

Thus, a conventional domestic clothes dryer can be replaced by the home-use unit 64, having all the functions of the domestic clothes dryer, most of the Dry-Wetcleaning capabilities of a commercial machine 10 according to the embodiment of FIGS. 1 and 2 and additionally have an integrated spotting station, a feature not found in commercial dry cleaners.

It also is possible to define a third, less expensive, embodiment of the home-use process and unit, a hybrid of the first two. Such hybrid would contain the vacuum operated spotting station, the drum mounted and/or  
5 loose pads and the manual kit, but would omit the automated, inside the drum, solvent spraying and the compressor powered sprayers. The sprayers 94, 96 would be manual.

If automated, in the drum, solvent spraying of FIG. 3, with secured and/or loose pads, was considered more  
10 desired than the spotting station of FIG. 4, a different hybrid process and apparatus could be created by elimination of the spotting station, keeping the spraying components of FIG. 3, and also omitting the kit K of FIG.  
15 5.

The hereinabove description of the commercial/professional and home-use processes and the embodiments of textile cleaning machine 10 and home-use unit 64 should enable those skilled in the art to  
20 construct new textile cleaning machines, or make modifications to an existing dry cleaning machine, or home-use clothes dried while remaining within the scope of the inventions. The same applies to the first described home-use process and the components kit K for  
25 use therewith.

That which we claim is:

1. In a process for cleaning soil from textile having at least two surfaces, the step of:
  - a. dampening the textile surfaces in a solvent, in the absence of soaking or immersing the  
5 textile in the solvent.
2. In the process according to claim 1, the further step of:
  - b. rubbing the textile surfaces with highly absorbent, untreated pad material, whereby the soil and  
5 solvent is transferred to the pad material.
3. In the process according to claim 2, said step of rubbing is accomplished in a rotating drum.
4. In the process according to claim 3, the further step of:
  - c. securing at least a significant portion of the pad material to the interior of the drum.



5. In the process according to claim 1,  
said step of dampening is accomplished in the  
interior of a rotatable drum and at least a portion of  
said dampening occurs while the drum is rotating.

6. A kit for use in the process according to claim  
3, said kit comprising:

a. textile cleaning solvent for manually  
accomplishing said step of dampening; and

5 b. said pad material.

7. a kit according to claim 6, in which:  
said pad material is the liner of a containment  
bag, into which the dampened textile is placed.

8. A home-use unit for conducting the process  
according to claim 1, said unit comprising:

a. the typical components of a home-use  
clothes dryer, including a rotatable drum which is  
5 normally closed when it is rotating;

b. automatically operating solvent spraying  
means, for spraying the textile in the rotating drum, to  
thereby dampen said textile.

9. The home-use unit according to claim 8, further including:

a. an integrated spotting station having a spotting board to which vacuum is provided.

10. Apparatus for cleaning textile, comprising:

a. an automatically operating, rotatable drum;

b. automatically operating spraying means  
5 constructed and arranged within said apparatus for dampening the textile with solvent, in the absence of soaking or immersing the textile in the solvent.

11. Apparatus according to claim 10, further including:

c. means within said drum for securing highly absorbent, untreated pad material, which is to come into  
5 frequent, random rubbing contact with the textile in the rotating drum.

12. Apparatus according to claim 11, and in addition thereto:

d. highly absorbent, untreated pad material,  
at least some of said pad material being secured within  
5 said drum.

13. An apparatus according to claim 10, further including:

- c. an integrated spotting station; and
- d. means for supply vacuum to said spotting

5 station.

14. Apparatus according to claim 10, in which;

said spraying means is constructed and arranged for spraying one or more of: solvent, air, water and steam into said drum, in the absence of soaking or immersing

5 the textile in any one or more of the water and steam.

10 *Fig. 1*

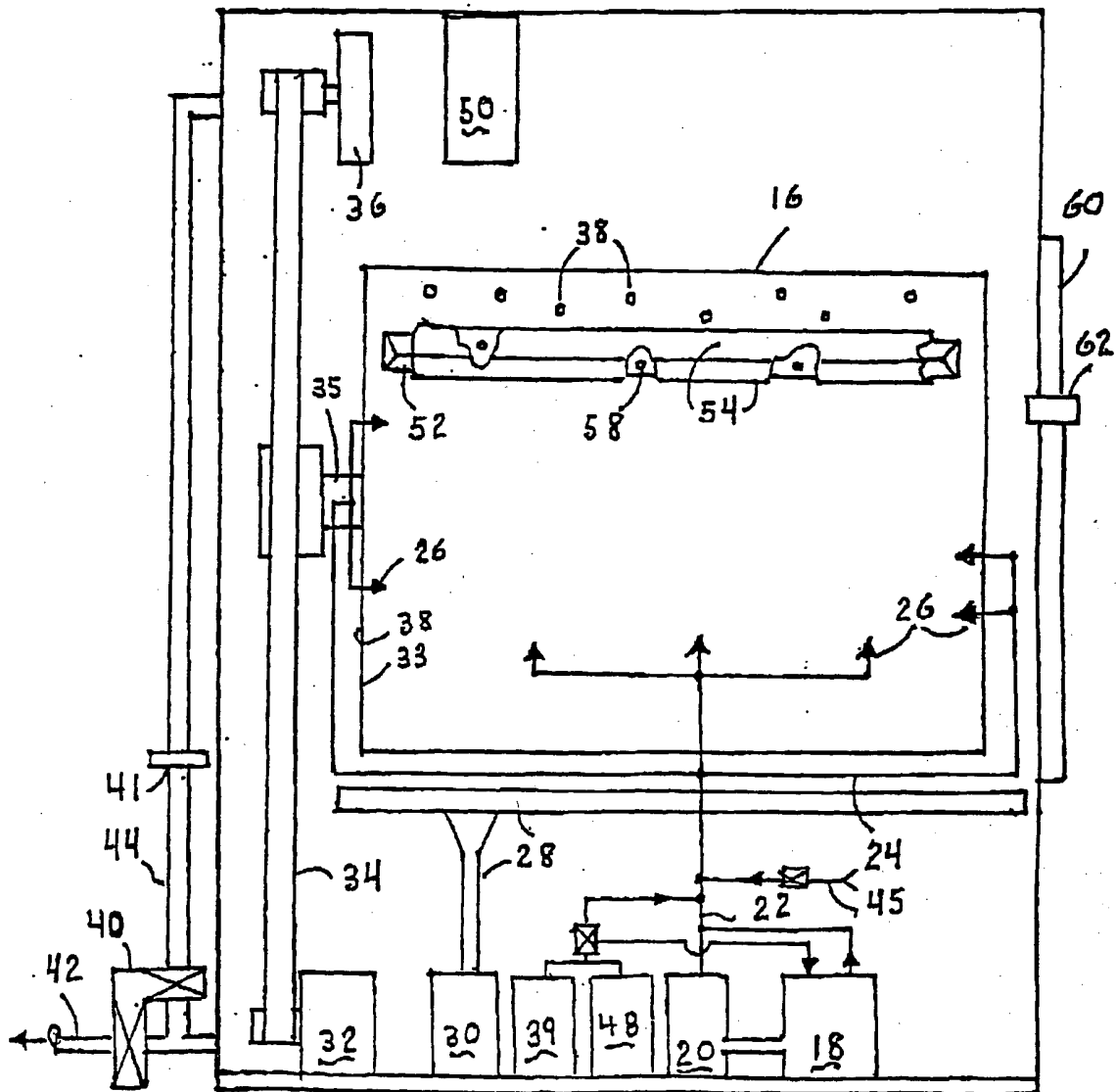
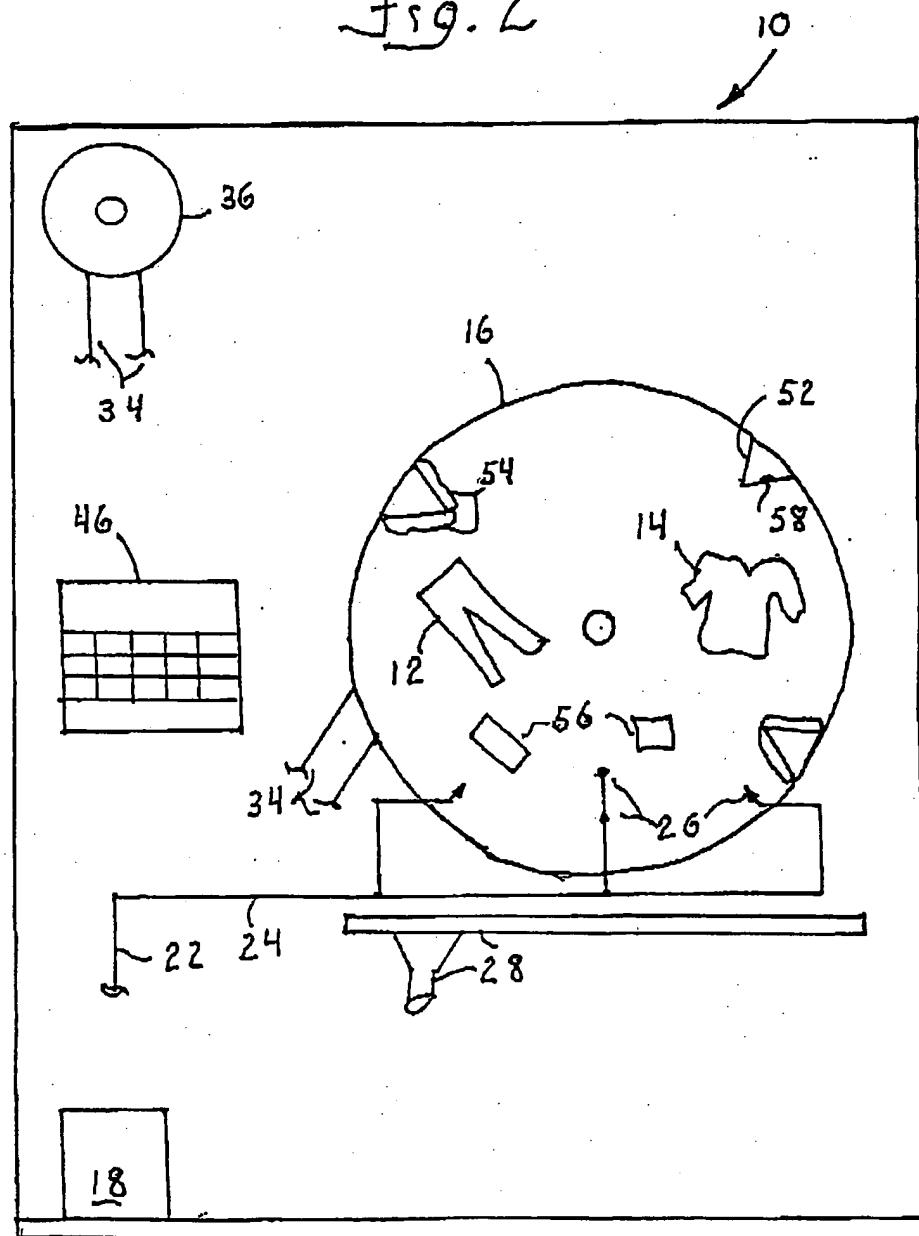
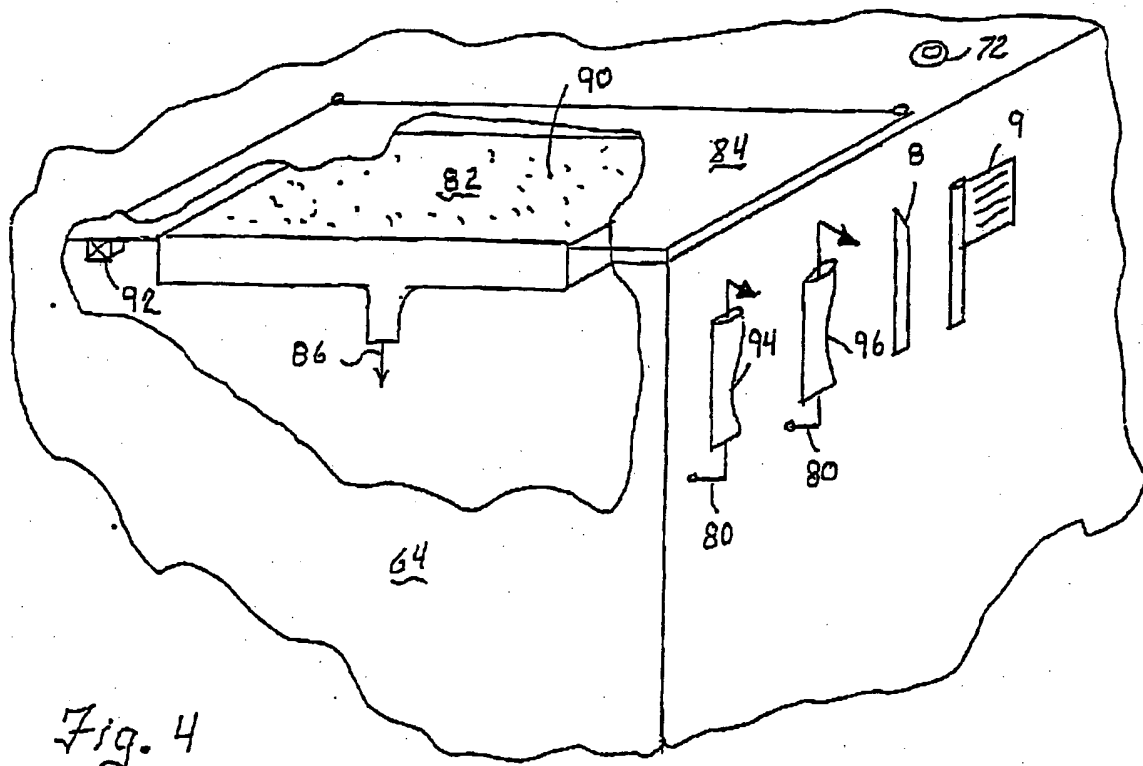
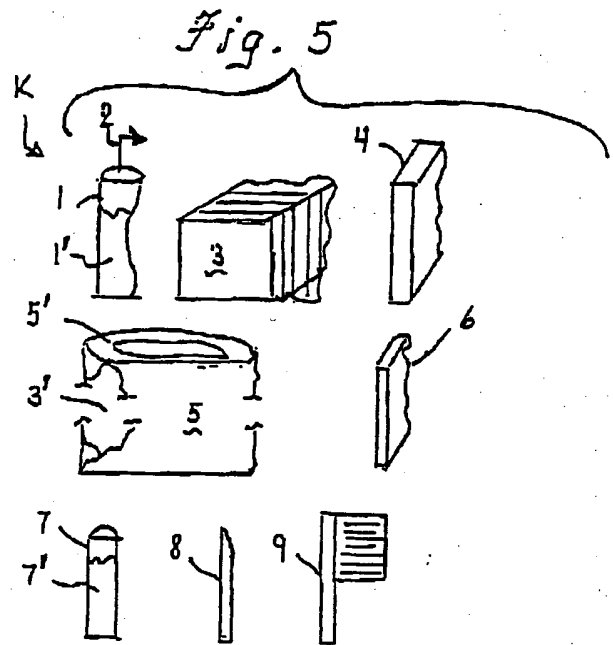
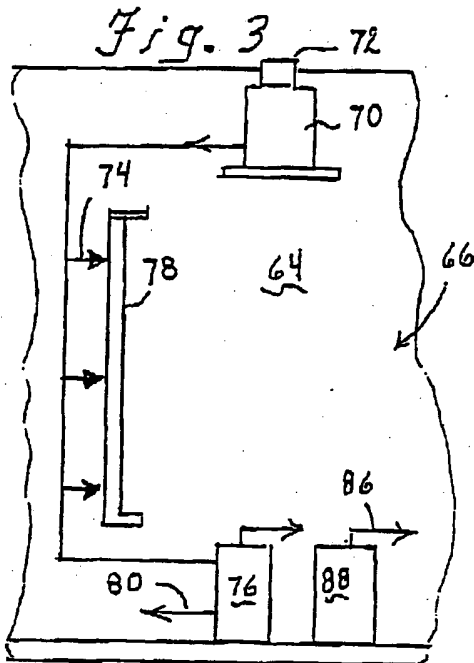


Fig. 2



3/3



## INTERNATIONAL SEARCH REPORT

 International application No.  
 PCT/US01/23444

## A. CLASSIFICATION OF SUBJECT MATTER

 IPC(7) :D06F 43/00  
 US CL :8/158; 68/5C, 29, 142, 235R, 240; 510/282  
 According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 8/158; 68/5C, 28, 29, 30, 142, 213, 235R, 240; 510/282, 283, 297; 206/213, 320

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category <sup>o</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,891,197 A (YOUNG et al) 06 April 1999, entire document	1-3,5-7 — 4
X — Y	US 5,951,716 A (LUCIA, III et al) 14 September 1999, entire document	1-3,5-7 — 4
X — Y	US 5,595,071 A (PASAD et al) 21 January 1997, entire document	8,10,14 — 9,11-13
Y	US 3,261,185 A (RIHR) 19 July 1966, entire document	4
Y	US 5,253,378 A (JUNG, Jr) 19 October 1993, entire document	9,13
Y	US 3,146,196 A (BOCHAN et al) 25 August 1964, entire document	11,12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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24 SEPTEMBER 2001

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25 OCT 2001

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